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## INITIAL SPURT IN A SIMPLE MENTAL FUNCTION

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In a recent article<sup>1</sup> on initial spurt one of the writers intimated that this subject was being further investigated using shorter intervals of time. This paper records the result of that investigation. As was pointed out in the paper, to which reference has been made, the weakness of previous experiments on initial spurt has been the use of successive intervals of time of too long duration to reveal the rapid decline in efficiency which takes place. Consequently the effect of the spurt has been so neutralized as to escape attention. The former study in which two-minute intervals were used showed undeniable signs of initial spurt, but it appeared that the effect would have been more evident if shorter intervals had been employed. For this reason, in the present study it was thought advisable to resort to intervals of thirty seconds. This interval was judged the minimum which would not interfere with the freedom of the subjects in their work.

The general method of the experiment was similar to that already described. The subjects were tested in continuous addition for sixteen minutes on seven successive occasions. The addition blanks consisted of forty-eight columns of ten one-place numbers, and were similar to those used by Thorndike<sup>2</sup> and other experimenters. Five different sheets in all were employed so as to eliminate any memory effect. The experiment was conducted as follows. The sheets were supplied to the subjects face down. At the word, "Commence," the subjects reversed these sheets, and commenced to add down the columns. At each thirty-second interval the word, "Check," was called at which time the subject made a small tick on the right-hand side of the column on which work was being done. This mark indicated the exact place in the column which the subject had reached. The checking very soon became automatic, and was practiced before the data of the research were collected.

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<sup>1</sup> Chapman, *Jour. Educ. Psych.*, Vol. 6, Sep. 1915.

<sup>2</sup> Thorndike, *Amer. Jour. Psych.*, Vol. 21, 1910, p. 483.

Obviously in an investigation of this kind great care has to be taken that the subjects do not add in advance of the experiment. This was eliminated not only by keeping the sheets reversed before the experiment started but also by announcing the number of the column on which to commence work just previous to the starting signal. The subjects were not informed that the results would be used to investigate the problem of initial spurt. The tests were administered a week apart to twenty individuals who took the tests on the average seven times. The subjects were girls of an average age of seventeen, attending a private school in Cleveland. Each week the results of the previous tests were announced with the object of maintaining interest.

The basis of scoring was to allow ten for each column correctly added, since there are ten additions in each problem. No allowance was made for the time spent in writing the sum at the base. For each column in which an error was made ten was deducted. This possibly inflicted too high a penalty for errors, as in a normal case not more than one or two errors would be made in the same column. It seemed desirable however to inflict this penalty as it presents the only perfectly safe scoring basis. In this way it is possible, counting

TABLE I  
AGGREGATE SCORES DURING EACH SUCCESSIVE HALF-MINUTE PERIOD  
Fifteen minutes' continuous work on each day (Periods 1-30)  
Twenty subjects tested on seven days

Half-minute period	Total uncorrected score	Total errors	Total corrected score	Half-minute period	Total uncorrected score	Total errors	Total corrected score
1	2858	582	2276	16	2176	453	1723
2	2511	476	2034	17	2234	404	1830
3	2363	575	1788	18	2125	389	1756
4	2251	437	1814	19	2262	413	1849
5	2274	446	1828	20	2152	543	1609
6	2254	337	1917	21	2247	463	1784
7	2315	419	1896	22	2195	443	1752
8	2192	440	1752	23	2242	488	1754
9	2349	462	1887	24	2232	384	1848
10	2221	511	1710	25	2298	478	1820
11	2258	417	1841	26	2290	504	1786
12	2183	498	1685	27	2185	452	1733
13	2140	418	1722	28	2236	438	1798
14	2141	436	1715	29	2294	484	1810
15	2174	414	1760	30	2188	406	1782

each separate addition as a unit, to determine the exact amount of work done during each successive half-minute period.

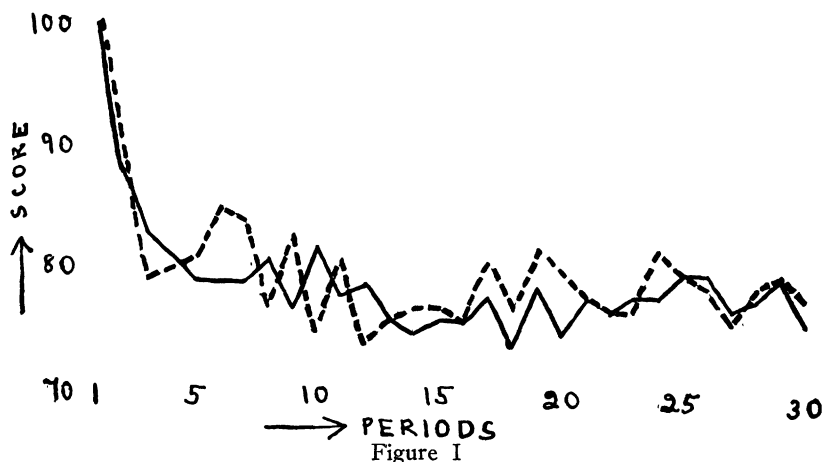
The aggregate scores of all the individuals tested on the seven occasions in each successive half-minute period are shown in Table I. It will be seen that only thirty half-minute periods are recorded in order to eliminate any possible so-called end-spurt effects. The number of errors during each of these successive half-minutes is also recorded from which the corrected aggregate scores of each of the half-minute periods were obtained.

From Table I it will be seen that both the uncorrected and the corrected scores show a considerable initial spurt. This is markedly true in the case of the first period, but even in the second period it is still apparent; the efficiency during the second period never being equalled during any later period. In Table II the uncorrected and corrected scores of each successive half-minute are reduced to a percentage basis, in each case the product of the first half-minute being arbitrarily chosen as 100%.

TABLE II  
SCORES REDUCED TO PERCENTAGE BASIS  
(Score during first period = 100)

Half-minute period	Uncorrected score	Corrected score	Half-minute period	Uncorrected score	Corrected score
1	100	100	16	76	76
2	88	89	17	78	81
3	83	79	18	74	77
4	83	80	19	79	82
5	79	81	20	75	71
6	79	85	21	78	78
7	79	84	22	77	77
8	81	77	23	78	77
9	77	83	24	78	82
10	82	75	25	80	80
11	78	81	26	80	79
12	79	74	27	77	76
13	76	76	28	78	79
14	75	77	29	80	80
15	76	77	30	76	78

Table II only serves to bring out more clearly the facts recorded in Table I. A graphic representation of Table II is shown in Figure I.



In this figure the uncorrected score is represented by the continuous line, and the corrected score by the broken line. It will be seen that there is a large decline in efficiency in the curves representing both the corrected and uncorrected scores.

Perhaps the most advantageous method of presenting the results of this experiment is to compare the score during each early half-minute period with the average score of the last twenty half-minute periods. This has been done in Table III which shows the percentage amount by which each of the first ten half-minute periods exceeds the average of the last twenty half-minute periods in the case of both the corrected and uncorrected scores.

TABLE III

Average scores (periods 11-30) is exceeded by score during period shown below by percentage recorded in Columns I and II	Column I Uncorrected score	Column II Corrected score
	Percentages	Percentages
1.....	28.8	28.8
2.....	13.1	14.7
3.....	6.3	1.1
4.....	6.3	2.3
5.....	1.4	3.4
6.....	2.3	8.5
7.....	1.4	7.3
8.....	4.5	-1.1
9.....	-1.4	6.8
10.....	5.9	-3.4

From this table we find that 28.8% more work is done during the first interval than during the average of the last twenty intervals. Considering the second interval in the case of the corrected score there is 14.7% more efficiency, and the corresponding figure for the uncorrected score is 13.1%. Even leaving the first interval out of consideration the efficiency during the second period would establish a claim for initial spurt.

When this conclusion is considered in the light of the results which have been obtained on the decrease of mental efficiency due to fatigue,<sup>3</sup> which indicate that in a mental function of this kind not more than a 10% decrease may be expected as a result of twelve hours' continuous work, some idea can be obtained of the decline in efficiency which is represented by a fall of 28.8% in product produced.

An examination of the corrected scores of the twenty individuals taking part in the test is instructive. In the case of 80% of the subjects the total scores of the periods 1-5 exceeded the scores of the period 26-30. A comparison of the totals of the periods 1-3 with the totals of the periods 11-13 shows that 90% of the individuals were more efficient during the first three periods.

Although the errors during the first period are greater than during any successive period, arithmetical analysis shows that there is no method of penalizing the errors so as to reduce initial spurt to zero in the corrected score.

In view of the fact that the use of shorter intervals has revealed a more pronounced initial spurt effect, it does not seem possible to deny the presence of this factor. The subject when set to mental work of this type, owing probably to absence of interference, commences at a speed which is greater than he can maintain. He very rapidly settles down to a normal rate at which he can work for long periods. It is the rapidity of this decrease in efficiency which has led to the fact that initial spurt has been overlooked and even denied.

Our best thanks are due to the authorities of the Laurel School, Cleveland, for their courtesy in allowing facilities for this work, and also to Miss M. E. Hills for her assistance in conducting the class experiment.

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<sup>3</sup> Hollingworth, *Psych. Review*, Vol. 21, No. 6, p. 473, Nov. 1914.